** ADJUST CONTRACT TIME IF NECESSARY TO ALLOW FOR 45-DAY MAINTENANCE PERIOD. **

** INSERT JOB SPECIFIC LANGUAGE FOR TYPE OF SEED AND SPECIFIC LOCATIONS ON PAGE 3. INCLUDE SUBSTITUTION VALUES IN TABLE 1. **

(805SEED, 07/27/05)

ITEM 8050003 - SEEDING (CLASS II):

1.0 Description:

The work under this item shall consist of furnishing all materials, preparing the soil, applying Class II seed, and establishing the seeded areas.

Areas to be seeded are those disturbed or unvegetated areas listed herein, shown on the plans, called for in the contractor's erosion control plan, or designated by the Engineer.

Seeding may be included as part of a landscape project as specified in Section 807, or used for erosion control as part of a Storm Water Pollution Prevention Plan (SWPPP) as specified in Subsection 104.09 of the specifications, or both.

In either case, seeding shall be accomplished in two stages. The first stage shall consist of tillage, furnishing and applying chemical fertilizer, furnishing and planting the contract-specified seed mix, and furnishing, applying and affixing mulch. The second stage, beginning after the first stage has been accepted by the Engineer, shall be a 45 calendar-day period during which time the contractor shall be responsible for maintaining and stabilizing the seeded and mulched areas, and restoring damaged or eroded areas.

Seeding used as part of a SWPPP shall be completed, including the 45 calendar-day maintenance period, before the end of the contract time, or sooner as specified in the SWPPP. Seeding used as part of a landscape project shall be completed, including the 45 calendar-day maintenance period, before the end of the Construction Phase. When seeding is part of a landscape project, the maintenance activities described herein shall be in addition to the work specified in Section 807 for landscape establishment. No time extension will be granted for seeding not completed as specified herein, including the 45 calendar-day maintenance period, before the end of the contract time or Construction Phase as applicable.

2.0 Materials:

2.01 General:

Appropriate documentation, as specified below, shall be submitted to the Engineer a minimum of 30 calendar days before the start of a scheduled seeding activity. No materials shall be delivered to the site until the documentation has been approved by the Engineer.

Unless otherwise specified, Certificates of Compliance conforming to the requirements of Subsection 106.05 of the specifications shall be provided for all materials.

Unless otherwise specified, the contractor shall perform all testing, or provide test results to the Engineer from accredited laboratories as specified herein.

2.02 Seed:

(A) General Requirements:

The species, variety, and strain of seed (designated elsewhere herein as contract-specified seed) shall be as shown on the plans or as specified herein. The contract-specified seed shall be obtained from seed suppliers through harvesting of wildland collections, or field-grown seeds grown prior to or during the contract period.

Within 30 calendar days after the award of contract, the contractor shall submit the name of the seeding subcontractor to be used, along with written confirmation from seed suppliers and collectors, on their letterhead, that the source(s) for the contract-specified seed has been secured. If any of the contract-specified seed is expected to not be available during the contract period prior to seeding, in accordance with Subsection 2.02(B) below, the contractor shall notify the Engineer at this same time.

The seed shall be delivered to the project site unmixed in standard, sealed, undamaged containers for each seed species. Each container shall be labeled in accordance with the appropriate provisions of the Arizona Revised Statues and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act. Labels shall indicate the variety or strain of seed, the percentage of germination, purity and weed content, the date of analysis which shall not be more than nine months prior to the delivery date, and testing information. A Certificate of Analysis from an accredited seed-testing laboratory, and conforming to Subsection 106.05 of the specifications, shall accompany each container of seed.

Unless otherwise approved by the Engineer, weed content of the contract-specified seed mix shall not exceed 0.5 percent.

The contractor shall provide all seed tag labels to the Engineer. No payment will be made for seed unless tag labels from all seed to be used on the project have been submitted as specified.

The contractor shall store seed under dry conditions, at temperatures of between 35 °F and 120 °F, and out of direct sunlight. Prior to using the seed, the contractor shall provide a certification letter to the Engineer that the seed was stored as specified herein.

Legume seed shall be inoculated with appropriate bacteria cultures approved by the Engineer, in accordance with the culture manufacturer's instructions.

Tetrazolium staining shall be acceptable to test for germination and hard seed. Cut or fill testing will not be allowed. As directed by the Engineer, seeds with an expiration date past

the acceptable test date or not meeting the specified conditions for storage shall be retested by the contractor. The Engineer may perform random sampling of seeds throughout the project. Mixing of the specified seed at the project site shall be under the supervision of the Engineer.

Application rates of seed as specified are for Pure Live Seed (PLS). PLS is determined by multiplying the sum of the percent germination of seeds, including hard or dormant seeds, by the percent purity.

Seed mix species and the Pure Live Seed (PLS) rates are shown in Table 1 below:

*** INSERT JOB SPECIFIC LANGUAGE FOR TYPE OF SEED AND SPECIFIC LOCATIONS. INCLUDE SUBSTITUTION VALUES IN TABLE 1 BELOW. ***

TABLE 1					
SEED MIX					
Botanical Name	Common Name	PLS Rate (Pounds Per Acre)	Per Pound Value for Substitution (see text)		

(B) Seed Substitution:

No substitution of the contract-specified seed will be allowed unless evidence is submitted documenting that the contractor has made a diligent effort to obtain the contract-specified seed, from either seed suppliers or collectors, and that the contract-specified seed will not become available prior to the time specified for seeding in the contractor's approved construction schedule.

The contractor may also request a substitution if the lowest price available for the contract-specified seed is greater than 2.0 times the value shown in Table 1. The contractor shall provide documentation from a minimum of three seed suppliers or collectors supporting such request. Documentation shall include copies of the invoices from each supplier or collector. Only those invoices obtained within three weeks of the time specified for seeding in the contractor's approved construction schedule will be acceptable.

Should a substitution of the contract-specified seed be requested for one of the two reasons specified above, and the contractor's documentation is approved by the Engineer, the Department's Roadside Development Section will specify an alternate seed within five working days of the Engineer's approval of the contractor's documentation. The alternate seed will only be allowed when there is an insufficient quantity of the contract-specified seed, as determined in the previous two paragraphs, for the areas to be seeded as called for herein or as required for erosion control. The contractor shall obtain and apply the alternate seed, as required, to all such remaining areas. Unless otherwise approved by the Engineer, the approved alternate seed will only be allowed until such time that

contract-specified seed meeting the availability and price requirements specified herein can be provided.

For each pound of contract-specified seed not provided by the contractor, the value indicated in Table 1 will be deducted from the contract amount. The price per pound for the alternate seed selected by the Department, as specified above, will be determined in accordance with Subsection 109.04(D)(2) of the specifications. No additional adjustments will be made for substituting the alternate seed, the costs being considered as included in the contract item for seeding.

No payment will be made for areas seeded with unapproved seed.

2.03 Tacking Agent:

Tacking agent shall be a naturally occurring organic compound and be non toxic. It shall be a product typically used for binding soil and mulch in seeding or erosion control operations. Approved types shall consist of mucilage or gum by dry weight as active ingredient obtained from guar or plantago. The tacking agent shall be labeled indicating the type and mucilage purity.

The contractor shall have the tacking agent swell volume tested by an approved testing laboratory using the USP method. The standard swell volume shall be considered at 30 milliliters per gram. Material shall have a swell volume of at least 24 milliliters per gram. Certified laboratory test results shall be furnished to the Engineer for each shipment of homogenous consistency to be used on project areas or as directed by the Engineer. Tacking agent rates shall be adjusted to compensate for swell volume variation. Material tested with lesser volume shall have the tacking agent rate increased by the same percentage of decrease in swell volume from the standard 30 milliliters per gram. Material tested with greater volume may reduce tacking agent rates by the same percentage of increase in swell volume from the standard 30 milliliters per gram. Tacking agent shall be pure material without other starches, bentonite, or other compounds that would alter the swell volume test results of mucilage, or the effectiveness of the tacking.

2.04 Wood Fiber Mulch:

Wood cellulose fiber mulch shall conform to the requirements of Subsection 805-2.03 of the Standard Specifications, except as modified herein, and shall be from thermo-mechanically processed wood, processed to contain no growth germination inhibiting factors. The mulch shall be from virgin wood manufactured and processed so the fibers will remain in uniform suspension in water under agitation to form homogenous slurry. Paper products will not be considered as virgin wood. The wood fiber mulch shall have the properties shown in Table 2 below:

TABLE 2		
Virgin Wood Cellulose Fiber	90% min.	
Recycled Cellulose Fiber	10% max.	
Ash Content	0.8% +/-0.3%	
PH	4.5 +/-1.0	

For reference only. Visit ADOT C&S web link below for the most recent updates. http://www.azdot.gov/highways/cns/CNS Stored specs.asp

I water Holding Capacity I Tutt (water tiber)	Water Holding Capacity	10:1 (water:fiber)
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2.05 Straw Mulch:

Straw mulch shall conform to the requirements of Subsection 805-2.03 of the Standard Specifications, except as modified herein, and shall be from the current season's crop. A letter of certification from the supplier shall be required stating that the straw was baled less than 12 months from the delivery date.

All wheat straw shall be free from noxious weeds in compliance with the standards and procedures of the North American Weed Management Association (NAWMA) or the Arizona Crop Improvement Association (ACIA). The contractor shall provide documentation, including a transit certificate, and appropriate labels and/or marking twine, from the ACIA or NAWMA that wheat straw to be used for mulch is free of noxious weeds. The wheat straw shall be accompanied by the certification, labels and/or marking twine at the time of delivery to the project site. Wheat straw delivered to the project without such information will be rejected, and promptly removed from the project.

Rye straw and oat straw will not be acceptable.

2.06 Chemical Fertilizer and Sulfur:

Chemical fertilizer shall conform to the requirements of Subsection 805-2.06 of the specifications and shall be the kind hereafter specified. Fertilizer shall be composed of a mixture of one part sulfur-coated urea 25-4-8, one part monammonium phosphate 11-52-0, and one part methylene urea 38-0-0. The sulfur-coated urea, a blended fertilizer 25-4-8, shall have 80 percent of the nitrogen defined as slow release, and contain 5 percent Iron, 10 percent sulfur and trace amounts of zinc and manganese. The resulting 24-18-2 chemical blended fertilizer, as specified herein, shall be applied at the rate of 200 pounds per acre. In addition to the fertilizer mixture, agricultural sulfur compounds, comprised of between 80 percent and 96 percent sulfur, shall be applied at the rate of 200 pounds per acre.

2.07 Water:

Water shall be free of oil, acid, salts or other substances which are harmful to plants. The source shall be as approved by the Engineer prior to use.

2.08 Compost:

Compost shall consist of composted organic vegetative materials. Prior to being furnished on the project, compost mulch samples shall be tested for the specified microbiological and nutrient conditions, including maturity and stability, by a testing laboratory approved for testing of organic materials. Written test results shall be submitted to the Engineer for approval.

Compost material shall be dark brown in color with the parent material composted and no longer visible. The structure shall be a mixture of fine and medium size particles and humus crumbs. The maximum particle size shall be within the capacity of the contractor's

equipment for application to the constructed slopes. The odor shall be that of rich humus with no ammonia or anaerobic odors.

Compost shall also meet the requirements of Table 3:

TABLE 3			
Cation Exchange Capacity (CEC)	Greater than 60 meq/100 g		
Carbon:Nitrogen Ratio	Less than 20:1		
pH (of extract)	6.0 – 8.5		
Organic Matter Content	Greater than 25%		
Total Nitrogen (not added)	Greater than 1%		
Humic Acid	Greater than 5%		
Maturity Index	Greater than 50% on Maturity Index		
	at a 10:1 ratio		
Stability	Less than 100 mb 02/Kg compost dry		
	solids – hour		

When specified, compost shall be applied to areas to be seeded at the specified rate per acre prior to final tillage for incorporation into the soil seedbed. Unless otherwise specified, compost shall be applied to areas to be seeded at 12 cubic yards per acre prior to final tillage for incorporation into the soil seedbed.

2.09 Soil Conditioners:

Soil conditioners, when required, will be as shown in the Special Provisions.

3.0 Construction Requirements:

3.01 General:

The contractor shall notify the Engineer at least two days prior to commencing seeding operations.

The equipment and methods used to distribute seeding materials shall provide an even and uniform application of seed, mulch, and other materials at the specified rates.

Unless specified otherwise in the Special Provisions, seeding operations shall not be performed on undisturbed soil outside the clearing and grubbing limits of the project or on steep rock cuts.

The contractor shall coordinate the seeding operations with the grading operations to determine mobilization frequency as embankment and cut slopes are finished throughout the duration of the project. Seeding shall be done during suitable weather and soil conditions for tillage and placement of materials. Seeding operations shall not be performed when wind would prevent uniform application of materials or would carry seeding materials into areas not designated to be seeded.

The contractor shall not expose an area greater than 750,000 square feet at any one location within the project limits until the seeding proposed for that portion of the project has been installed and accepted by the Engineer. Seeding shall be accomplished within 14 days after slopes and disturbed areas have been completed. Seeding operations shall comply with Subsection 104.09 and the applicable portions of Section 203 of the specifications, and as directed by the Engineer.

Frequent mobilizations may be required to accomplish seeding as specified herein. The Department will consider the cost of such multiple mobilizations to be included in the price bid for the seeding. No adjustments will be made to the contract for the number of seeding mobilization activities. Should the contractor fail to provide seeding for a sub-area as specified herein, the Engineer will immediately notify the contractor of such non-compliance. Should the contractor fail to immediately remedy the unstabilized area, the Engineer may suspend work until such seeding stabilization has been completed, or proceed to provide the necessary seeding stabilization. The entire cost of such work will be deducted from the monies due or to become due to the contractor. In addition, no adjustment to the contract time will be made for suspensions resulting from the contractor's failure to provide seeding for a sub-area within the time periods specified herein.

Seeding shall also be applied to all new earthen and milled asphaltic concrete shoulder build-up areas. Unless directed by the Engineer, shoulder build-up areas shall not be tilled prior to seeding. Seeding and mulching shall be done in two separate steps. For the first step, seed shall be applied by hydroseeding for both types of shoulder build-up areas. For the second step, seeded shoulders comprised of milled asphaltic concrete shall have wood fiber mulch and tacking agent applied. For seeded earthen shoulders, the second step shall be application of straw mulch with tacking agent.

3.02 Tillage:

Where equipment can operate, the area to be seeded shall be prepared with a ripper bar, chisel plow, or with other devices, which will provide thorough soil cultivation to the depth specified below. For areas too steep to be prepared for seeding after the slope has been completed, as determined by the Engineer, tillage shall be accomplished with appropriate equipment as the slope is being constructed. On slope areas, all tillage shall be directional along the contours of the areas involved. All areas, which are eroded shall be restored to the specified condition, grade and slope as directed prior to seeding.

On cut and fill slopes the operations shall be conducted in such a manner as to form minor ridges thereon to assist in retarding erosion and favor germination of the seed.

Except as specified herein, slopes shall be constructed in accordance with Subsection 203-3.03(B) of the specifications. Cut slopes flatter than 3:1 (horizontal to vertical) shall be tilled a minimum of 12 inches in depth, and fill slopes flatter than 3:1 shall be tilled to a sixinch minimum depth. All slopes steeper than 3:1, and areas which could potentially be affected by underground utilities, shall be tilled to a minimum 6 inches in depth, and left in a roughened condition as they are constructed.

Care shall be taken during the seeding operations to prevent damage to existing trees and shrubs in the seeding area in accordance with the requirements of Subsection 107.11 of the specifications.

Tillage may require passing the equipment over the area several times to provide thorough soil cultivation. Furrows from tillage shall be no more than 12 inches apart. No work shall be done when the moisture content of the soil is unfavorable to tillage.

All competitive vegetation shall be uprooted prior to seeding and the soil shall be left in a friable roughened condition free of clods or large stones over four inches in any dimension and other foreign material that would interfere with the seeding operation. Exposed stones larger than four inches shall be removed and disposed of in an approved manner prior to grading and seeding.

Regardless of the method of seeding application, all areas prepared with tilling shall have fertilizer and compost uniformly applied and incorporated into the soil at the specified rates per acre with final tillage and seeding. Slopes 3:1 and flatter shall have fertilizer and compost tilled into a minimum of the top four inches of the surface. Slopes steeper than 3:1 shall have fertilizer, soil amendments, and compost applied for incorporation into the soil as directed by the Engineer.

For mini-benched slopes, fertilizer, compost, and soil amendments shall be applied to at the specified rates with no tillage or incorporation.

3.03 Seeding:

(A) General:

Drill seeding with straw mulch shall be considered as the preferred method of seed application when practicable. Unless otherwise specified by the Engineer, drill seeding shall be used for all areas with slopes of 3:1 or less.

Hydroseeding shall be the alternative method for seed distribution for slopes in excess of 3:1, and where drill seeding is not practicable or suitable for soil conditions and seed types, as determined by the Engineer.

Straw mulch or wood fiber mulch shall be applied on drilled or hydroseeded areas with crimping and tacking, as specified herein or directed by the Engineer, within 24 hours of seed application.

Unless otherwise specified in the Special Provisions, Class II seeding areas shall not be watered after planting.

(B) Drill Method:

After the tillage and incorporation of fertilizer and compost is completed and accepted by the Engineer, seed shall be planted with a drill seeder capable of accurately metering the

specific seed mix. Use of a drill seeder shall not damage the prepared seedbed, and shall provide a soil cover over the planted seed.

Seed shall be planted approximately 1/4 inch deep, with a maximum depth of 1/2 inch. The distance between the furrows produced using the drill process shall not be more than eight inches. If the furrow openers on the drill exceed eight inches, the area shall be drilled twice. Seeding shall be done with grass seeding equipment with double disc openers, depth bands, packer wheels or drag chains, rate control attachments, seed boxes with agitators and separate boxes for small seed. Seed of different sizes shall be sowed from at least two separate boxes adjusted or set to provide the planting rate as specified.

(C) Hydroseed Method:

Areas and seed types not suitable for drill-seeding, as directed by the Engineer, shall be hydroseeded with straw mulch or wood fiber mulch applied following application of the seed. The contract-specified seed shall be applied in a slurry containing a minimum of 40 pounds tacking agent and 200 pounds of wood fiber mulch per acre. Seed shall not be in the slurry for more than 30 minutes. Seed planted by this method will not require covering with soil. Soil areas shall be tilled to produce loose and friable surfaces with crusted hard soils broken up prior to hydroseeding.

3.04 Applying Straw Mulch:

(A) General:

Within 24 hours after each area is planted, straw mulch shall be uniformly applied at the minimum rate of 2 1/2 tons per acre for crimped and tacked areas and minimum 2 tons per acre for tacked-only areas. Unless otherwise specified by the Engineer, straw mulch shall be applied to both drill seeded and hydroseeded areas.

During seeding and mulching operations, care shall be exercised to prevent drift and displacement of materials. Mulch material which is placed upon trees and shrubs, roadways, structures and upon any areas where mulching is not specified or which is placed in excessive depths on mulching areas shall be removed as directed. Mulch materials which are deposited in a matted condition shall be loosened and uniformly spread, to the specified depth, over the mulching areas. Any unevenness in materials shall be immediately corrected by the contractor.

Except as specified in the next paragraph, straw mulch applied to drill seeded or hydroseeded areas shall be immediately affixed by crimping and tacking after application. No mulch shall be applied to seeding areas which can not be crimped and/or tacked by the end of each day. Any drifting or displacement of mulch before crimping and/or tacking shall be corrected by the contractor at no additional cost to the Department.

Crimping shall not be required for areas that are steeper than 3:1. Crimping may also be waived, when specifically directed by the Engineer, for drill seeded or hydroseeded areas with rocky conditions or other areas deemed unsuitable by the Engineer for crimping. Straw

mulch applied to such drill seeded or hydroseeded areas shall only be tacked, as specified in Subsection 3.04(C) below.

Prior to the application of a tacking agent, protective covering shall be placed on all structures and objects where stains would be objectionable. All necessary precautions shall be taken to protect the traveling public and vehicles from damage due to drifting spray.

(B) Anchorage by Crimping:

Except as specified above in 3.04(A), crimping shall be required for all straw mulched areas. Straw mulch shall be anchored into the soil with a heavy disc. Discs shall be flat and serrated with at least 1/4 inch thickness having dull edges and spaced no more than nine inches apart. Straw mulch shall be anchored to a depth of at least two inches and shall not be covered with an excessive amount of soil. Anchoring operations shall be across the slopes where practical with no more than two passes of the anchoring equipment. Immediately following the crimping operation, the crimped area shall be tacked as specified in Subsection 3.04(C) below.

(C) Anchorage by Tacking:

Straw mulch shall be anchored by tacking using a slurry consisting of a minimum of 150 pounds of tacking agent, 500 pounds of wood fiber mulch, and 300 gallons of water per acre. The contractor may increase the quantities of components to ensure the stability of the straw mulch to provide erosion control during the 45 calendar-day maintenance period at no additional cost to the Department.

3.05 Applying Wood Fiber Mulch with Tacking Agent:

Areas seeded but not practical for straw mulch, as determined by the Engineer, shall have wood fiber mulch with tacking agent applied at the variable rates shown in the Table 4 below.

TABLE 4				
Slope (H:V)	Tacking agent (Pounds pure mucilage per acre)	Wood Fiber Mulch (Pounds per acre)		
Flat to 4:1	50	1,000		
From greater than 4:1 to 3:1	100	2,000		
From greater than 3:1 to 2:1	150	2,500		
Greater than 2:1	200	3,000		
Erosive Soil Slopes*	300	3,500		
*As determined by Engineer				

The contractor shall submit a batch (tank) mix quantity schedule for seed application and the temporary erosion control mulch application for approval of the Engineers prior to mixing seed, fertilizer, wood fiber mulch and tacking agent in a slurry. Batch mixing and coverage

will be monitored throughout the seeding operations. The contractor shall coordinate the mixing and application operations with the Engineer in advance of all mixing.

3.06 Seeding Acceptance:

After application the Engineer will inspect seeded areas or sub-areas for conformance to the contract requirements. The contractor shall correct, to the satisfaction of the Engineer, any areas not conforming to the specifications. The 45-day maintenance period will begin upon acceptance of the area by the Engineer.

The contractor shall maintain and stabilize each area or sub-area, including shoulder build-up areas, for a minimum period of 45 calendar days after application of the seeding and mulching materials, and acceptance by the Engineer. Any areas damaged from erosion, or that have less than 90 percent of applied mulch remaining, shall be re-seeded, re-mulched, and re-tacked at no additional cost to the Department.

Except for landscape projects, seeding shall be completed, including the 45 calendar-day maintenance period, before the end of the contract time, or sooner if required in the SWPPP or elsewhere in the contract documents. Seeding used as part of a landscape project shall be completed, including the 45 calendar-day maintenance period, before the end of the Construction Phase.

4.0 Method of Measurement:

Seeding (Class II) will be measured by the acre, to the nearest one acre of ground surface seeded. Measurements will be along the ground surface for the areas seeded and mulched, as approved by the Engineer.

5.0 Basis of Payment:

The accepted quantities for Seeding (Class II), measured as provided above, will be paid in two phases corresponding to the application stage and the 45 calendar-day maintenance stage.

Upon completion of the application stage and acceptance by the Engineer, the contractor will be paid 70 percent of the contract bid price per acre for the completed work. Such price will be considered full compensation for furnishing and applying the contract-specified seed mix, fertilizers, soil amendments, tillage, mulch materials, and tacking agent, all required testing, and all equipment and labor required to complete the work as specified herein.

Upon completion of the 45 calendar-day maintenance stage, and acceptance by the Engineer, the contractor will be paid 30 percent of the contract bid price per acre for the completed work. Such price will be considered full compensation for seeding maintenance, including all equipment, labor, and materials required to correct deficiencies in seeded, mulched areas, as specified herein.

No measurement or payment will be made for the mobilizations required to apply and stabilize the seeding for each area or sub-area, as specified herein, the cost being considered as included in the contract price for Seeding (Class II).

An adjustment to the contract will be made if a contractor-requested seed substitution is approved as specified in Subsection 2.02(B) above.